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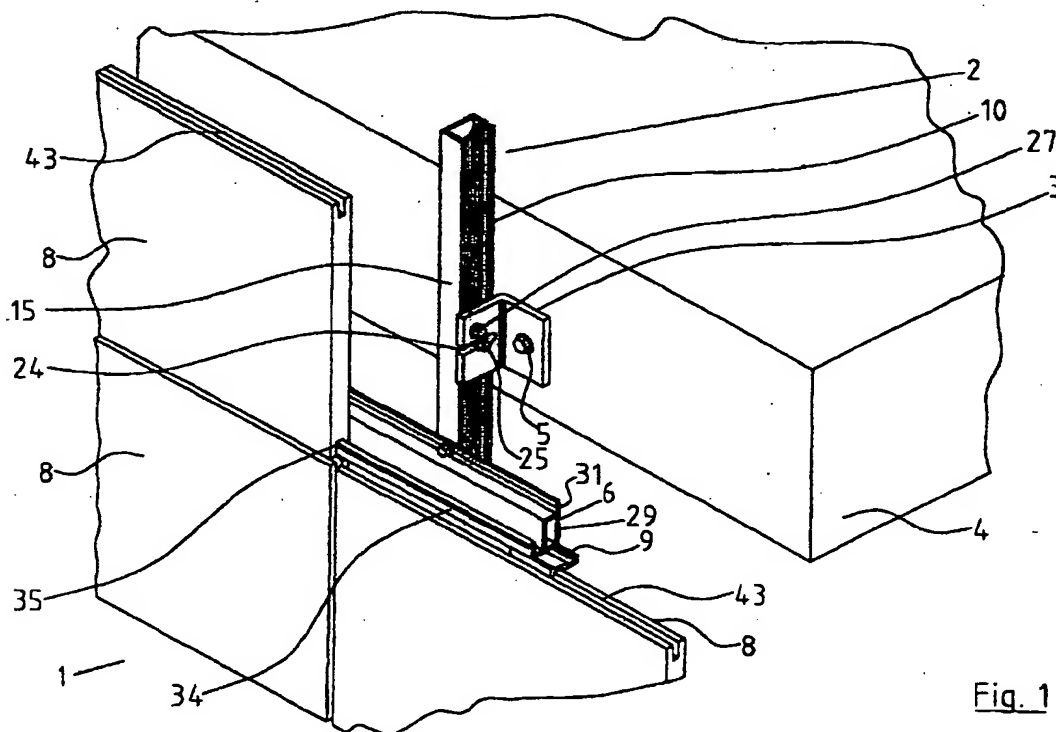
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**(54) A cladding system**

(57) A stone cladding system (1) for building has a support frame formed by a plurality of spaced-apart upright mullions (2) fixed to an exterior (4) of a building by anchor brackets (3), with a number of horizontal cladding panel support rails (6) mounted in vertically spaced-apart rows on the mullions (2). Each stone clad-

ding panel (8) is mounted between an adjacent pair of vertically spaced-apart rails (6) with a bottom of the cladding panel (8) seated on the lowermost rail (6) and a top of the cladding panel (8) secured to the uppermost rail (6) by a pair of retaining dips (9). A bottom of each stone cladding panel (8) is fully supported along its length by the lowermost rail (6).



**Fig. 1**

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## Description

### BACKGROUND OF THE INVENTION

#### Field of the Invention

[0001] The invention relates to a cladding system, and in particular to a cladding system for mounting stone cladding panels on an exterior of a building to form the façade of the building.

#### Description of the Prior Art

[0002] It is well known to provide stone cladding systems for buildings, particularly relatively large buildings, office blocks and the like, comprising a plurality of stone cladding panels secured to the building structure to form a wall by a mounting means engagable between the building structure and each panel. The cladding panels thus form the façade of the building. A known mounting means comprises an anchoring system which requires a brick or concrete wall to which mechanical anchors for each cladding panel are attached or embedded. The anchors fix the stone cladding panels in two load points at a bottom of each stone cladding panel and two restraint points at a top of the stone cladding panel. With this system, if the cladding panels need to be removed for replacement or access, for example, it is usually very difficult to do so and typically the mechanical anchors are damaged in the process. Further, the stone cladding panels have to be installed in a desired sequence, usually building up from the base of the building and the panels have to be checked frequently to ensure they are plumb and level. As can be appreciated, this is somewhat tedious and time consuming. A further disadvantage of the sequential construction method is that if during construction the next required cladding panels are not immediately available on site, the construction of the façade comes to a halt with consequent construction delays and added cost.

[0003] The present invention is directed towards overcoming these problems.

#### SUMMARY OF THE INVENTION

[0004] The invention is characterised in that the mounting means for each cladding panel comprises a pair of cladding panel support rails, namely an upper rail and a lower rail, means for mounting said rails in a substantially horizontal orientation and vertically spaced-apart on the building structure, a bottom of the cladding panel engaging and seating on the lower rail and retaining means being provided for releasably securing the top of the cladding panel to the upper rail.

[0005] Advantageously, in the cladding system of the present invention, each cladding panel is independently demountably secured between a pair of support rails. The cladding panel can be readily, easily and quickly

mounted on or removed from the support rails. This system also provides great flexibility in construction. The cladding panels can be mounted on the rails independently and out of any particular sequence so that there are no construction delays providing that there are some cladding panels available which can be mounted in any order on the rails. A further advantage is that the cladding panels can be mounted on the rails from the top of the building downwardly to the base of the building. This means that scaffolding required for mounting the cladding panels can be stripped away as the layers of cladding panels are completed moving downwardly from the top, thus providing a cost saving as the scaffolding is usually hired as needed for use on a building site.

[0006] In a particularly preferred embodiment, the bottom of each cladding panel is supported along substantially all of its length up the lower rail. This provides good support for the cladding panel. Also, providing it is ensured that the lower rail is horizontal, all the cladding panels in a row can be dropped onto the rail and they will be level. This facilitates speedy construction.

[0007] In a preferred embodiment, the rails are mounted upon a plurality of spaced-apart vertical mullions having associated anchor means for supporting each mullion in an upright orientation on the building structure. Thus conveniently, once the mullions are in place, the cladding panel support rails may be mounted on the mullions with any desired spacing between each row of rails. Further, in many cases, it will be possible to mount the mullions directly to the floors of the building structure which may mean it is not necessary to build a brick or block wall between the floors, again providing a saving in both time and cost.

[0008] While in some cases, it may be possible to mount the mullions directly to the support structure by means of an anchor bolt, for example, it is preferred that an anchor bracket is provided which conveniently may be L-shaped having a wall fixing plate which can be secured to the building structure by means of a bolt or the like and an outwardly extending mullion support plate which can be secured to the mullion in any suitable fashion such as by means of a locking bolt secured between the anchor bracket and the mullion.

[0009] Conveniently, complementary interengagable formations are provided upon associated mating faces of each anchor bracket and mullion. This advantageously provides resistance to wind shear. Preferably, the complementary interengagable formations comprise mating serrations on the mullion and on the anchor bracket. Ideally, the serrations have ridges arranged in a vertical orientation.

[0010] In a further embodiment, each mullion has two mutually perpendicular side faces of different depth. Thus conveniently, some adjustment of the spacing of the cladding panel from the building structure is provided. Each mullion is preferably of rectangular box section material.

[0011] In a further embodiment, a reentrant slot is pro-

vided along a face of the mullion for reception of a mounting bolt having a head and a shank, the head being slidably captured within the slot with the shank projecting outwardly of the slot for attachment to the mounting support for the mullion. This conveniently provides for ease of securing the mullions on the mounting support such as the anchor bracket as the mounting bolt can be slid along the slot for alignment with the anchor bracket. Typically, the anchor bracket has a slot for reception of the mounting bolt which may be open-ended to facilitate engagement of the bolt in the slot.

[0012] In another embodiment, the lower rail has an outwardly projecting panel support arm with an upturned flange at an outer end of the arm which is engagable within a mounting slot extending along a bottom edge of the panel. Thus, the bottom of each panel is securely retained on the lower rail.

[0013] In a further embodiment, the retaining means comprises a panel retaining clip, an outer end of the clip having a retaining flap engagable within a slot extending along a top edge of the panel, and an inner end of the clip being adapted for snap engagement with the upper rail.

#### **BRIEF DESCRIPTION OF THE DRAWINGS**

[0014] The invention will be more dearly understood by the following description of some embodiments thereof, given by way of example only, with reference to the accompanying drawings, in which:-

Fig. 1 is a detail partially cut-away perspective view of a cladding system according to the invention;

Fig. 2 is an end elevational view of a mullion forming portion of the cladding system;

Fig. 3 is an end elevational view of an anchor bracket forming portion of the cladding system;

Fig. 4 is an end elevational view of an intermediate cladding panel support rail forming portion of the cladding system;

Fig. 5 is a cladding panel retaining clip forming portion of the cladding system;

Fig. 6 is an end elevational view of a bottom cladding panel support rail of the cladding system;

Fig. 7 is an end elevational view of a top cladding panel support rail of the cladding system;

Fig. 8 is an end elevational view of another panel retaining dip of the cladding system;

Fig. 9 is a detail plan view showing the cladding system in use;

Fig. 10 is a view similar to Fig. 9 showing the cladding system in an alternative position of use;

Fig. 11 is a detail partially sectioned elevational view showing portion of the cladding system, in use;

Fig. 12 is a detail partially sectioned elevational view showing portion of the cladding system, in use;

Fig. 13 is a view similar to Fig. 12 showing an alternative arrangement of the cladding system;

Fig. 14 is an elevational view showing a portion of a stone cladding façade of the invention;

Fig. 15 is an elevational view of a cladding support frame of the invention; and

Fig. 16 is an end elevational view showing the cladding support frame mounted on a building.

#### **DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS**

[0015] Referring to the drawings, there is illustrated a cladding system according to the invention, indicated generally by the reference numeral 1. The cladding system 1 comprises a plurality of upright mullions 2 secured to an outside of a building by means of anchor brackets 3, shown in Fig. 1 secured to a floor 4 of the building by means of an anchor bolt 5. The mullions 2 are mounted at spaced intervals along an exterior of the building as best seen in Fig. 15. A number of horizontal cladding panel support rails 6 are mounted on the mullions 2 forming vertically spaced-apart rows of cladding panel support rails 6. Stone cladding panels 8 are mounted between each pair of vertically adjacent rows of panel support rails 6. A bottom of the cladding panel 8 seats on a lowermost rail 6 and a top of the cladding panel 8 is secured to the associated uppermost rail 6 by means of retaining clips 9. Typically, two retaining clips 9 are provided for each panel 8. The mullions 2, anchor brackets 3 and rails 6 are preferably manufactured from aluminium material and as can be seen in Fig. 15, they are assembled to form a mounting grid on a face of the building on which cladding panels 8 can be releasably mounted.

[0016] Referring in particular to Fig. 2, each mullion 2 is generally of box section extruded aluminium having serrations 10 along two mutually perpendicular adjacent walls of different widths, forming a wide anchor wall 11 and a narrow anchor wall 12. The remaining walls form a wide rail support wall 14 and a narrow rail support wall 15, each wall 14, 15 having a flat outer face. Depending on the orientation of the mullion 2 relative to the exterior of the building as shown in Figs. 9 and 10, the spacing of the rails 6 and hence the spacing of the cladding panels 8 from the exterior of the building can be adjusted

between a normal configuration shown in Fig. 9 with a wide cavity between the building and the cladding panels 8 and a narrow construction, as shown in Fig. 10 in which the mullion 2 is turned through 90°, with a narrow cavity between the cladding panels 8 and the building.

**[0017]** Reentrant slots 16 are provided along each of the serrated anchor walls 11, 12 of the mullion 2 for reception of a mounting bolt 17 (see Fig. 9) having a head 18 and a shank 19, the head 18 being slidably captured within the slot 16 with the shank 19 projecting outwardly of the slot for attachment of the mullion 2 to the anchor bracket 3.

**[0018]** Referring particularly to Figs. 1, 3 and 11, the anchor bracket 3 is of aluminium material and is L-shaped having an inner anchor plate 20 for attachment to the floor 4 or wall of the building. The anchor plate 20 has a through hole for reception of an anchor bolt 5 which secures the anchor bracket 3 to the floor 4 or wall of the building. Extending perpendicularly outwardly at one end of the anchor plate 20 is a mullion support plate 22, one face of which is provided with serrations 10 corresponding to the serrations 10 on the mullion 2. An open-ended mounting bolt receiving slot 24 extends inwardly from an outer edge of the mullion support plate 22. This elongate slot 24 allows for construction tolerances in the building structure when fixing the mullions in a vertical orientation. When the mullion 2 is engaged with the anchor bracket 3, the serrations 10 on the mullion 2 and anchor bracket 3 interengage and the mounting bolt 17 is slid along the slot 16 on the mullion 2 and is engaged with the slot 24 in the anchor bracket 3 and is secured thereto by means of a lock nut 25.

**[0019]** Additional self-drilling, self-tapping dead load screws 27 can be installed, as required, through the mullion support plate 22 of the anchor bracket 3 and into the mating serrated side wall 11, 12 of the mullion 2 to resist gravity load of the stone and aluminium. It will be noted that the serrations 10 are arranged in a vertical orientation to give a firm engagement between the mullions 2 and anchor brackets 3 which provide positive resistance against wind load without introducing shear on the mounting bolts.

**[0020]** Referring in particular to Fig. 4, each rail 6 has a generally box-section extruded aluminium body 29. An inner wall 30 of the body 29 is extended outwardly to form flanges 31 for attachment of the rail 6 to the mullions 2 by means of Elco Drilflex self tapping screws 47 with Stalguard coating. A lower wall 32 of the body 30 is extended outwardly to form a panel support arm 33 having an upturned flange 34 at an outer end of the arm 33 for engagement within an associated kerf or mounting slot 35 (Figs. 1 and 12) which extends continuously along a bottom edge of the cladding panel 8.

Extending outwardly from the flange 31 beneath the body 29 is a strip 36 which defines, with an underside of the body 30, a receiver 37 for snap engagement with the panel retaining dips 9.

**[0021]** Referring in particular to Fig. 5, the panel re-

taining clip 9 is generally L-shaped in section having a cranked horizontal top plate 38, an inner end of which terminates in a head 39 for snap engagement in the receiver 37, the head 39 having a shoulder 40 which catches behind a complementary shoulder 41 of the receiver 37. At an outer end of the plate 38 is a downwardly extending arm 42 which locates within an associated kerf or slot 43 extending continuously along a top edge of the cladding panel 8. A hooked lip 44 at an outer end of the top plate 38 engages within a complementary slot 45 in a front face of the flange 34 to retain an outer portion of the top plate 38 against an underside of the arm 33 when the dip 9 is engaged with the receiver 37 as can be seen in Fig. 12.

**[0022]** Fig. 6 shows an arrangement of the cladding panel support rail, in this case denoted 6a for mounting at a bottom of a stack of cladding panels 8. This does not have means for engagement with a mounting clip 9 as it simply supports the lowermost cladding panel in a stack of cladding panels.

**[0023]** Fig. 7 shows another arrangement of the cladding panel support rail, denoted 6b, for mounting at a top of a stack of cladding panels 8. A receiver 37 for reception of the retaining dip is provided in this case at a top of the body 29 and an associated top retaining clip 9a is provided for engagement with the receiver 37.

**[0024]** Referring in particular to Fig. 9, one arrangement of the mounting of a mullion 2 by means of the anchor bracket 3 on a floor 4 of the building is shown. An insulation panel 50 can conveniently be retained behind the mullion 2. In this case, the wide anchor wall 11 engages the anchor bracket 3.

**[0025]** Fig. 10 shows an alternative mounting arrangement for the mullion 2 where it is desired to provide a reduced cavity between the building and the cladding panels 8. In this case, the narrow anchor wall 12 engages the anchor bracket 3.

**[0026]** Fig. 11 shows an elevational view illustrating the mounting of a mullion 2 on the anchor bracket 3.

**[0027]** Fig. 12 shows the arrangement for securing the rail 6 on a mullion 2 with the seating of a cladding panel 8 on the rail 6 and the engagement of a retaining clip 9 with an underside of the rail 6 to secure an upper end of a lower panel 8 to the rail 6.

**[0028]** Fig. 13 shows an alternative arrangement of retaining clip 49 for securing a top of a lower panel 8 to an underside of the rail 6. In this case also, it will be noted that the inner faces of the slots 35, 43 are rebated.

**[0029]** Referring to Fig. 14, there is shown one possible arrangement of stone cladding panels 8.

**[0030]** Fig. 15 shows the arrangement of the mullions 2, anchor brackets 3 and rails 6 which essentially form a modular aluminium grid or frame on an exterior of the building on which the stone cladding panels 8 are releasably mounted.

**[0031]** Fig. 16 shows the mounting of the mullions 2 on a building with anchor brackets 3 being secured to floors 4 of the building with the mullions 2 mounted ther-

etween.

Where an intermediate wall 55 is provided between floors 4 of the building, an additional wind load anchor 56 may be provided between the mullions 2 and the wall 55. This can be similar to the anchor bracket 3 previously described. A number of mullions 2 can be joined end to end by means of fish plates 57 or other type of splicing bracket to form a continuous mullion 2 between a top and a bottom of the building.

[0032] It will be noted that each stone cladding panel is independently fixed on the support frame formed by the rails and mullions. Also, each stone cladding panel is supported continuously along a bottom of the cladding panel to provide an even load distribution. In many cases, no brick or block wall is required to support the frame formed by the mullions and rails. The system according to the invention provides great flexibility in that the stone cladding panels can be mounted on the rails in any order. Damaged or defective stone cladding panels can be easily replaced.

[0033] The invention is not limited to the embodiments hereinbefore described which may be varied in both construction and detail within the scope of the appended claims.

#### Claims

1. A stone cladding system (1) comprising a plurality of stone cladding panels (8) secured to a building structure (4) to form a wall by mounting means engagable between the building structure (4) and each panel (8), characterised in that the mounting means for each cladding panel (8) comprises a pair of cladding panel support rails (6), namely, an upper rail (6) and a lower rail (6), means for mounting said rails (6) in a substantially horizontal orientation and vertically spaced-apart on the building structure (4), a bottom of the cladding panel (8) engaging and seating on the lower rail (6) and retaining means (9) being provided for releasably securing the top of the cladding panel (8) to the upper rail (6).
2. A stone cladding system (1) as claimed in claim 1, wherein the bottom of the cladding panel (8) is supported along substantially all of its length upon the lower rail (6).
3. A stone cladding system (1) as claimed in claim 1 or claim 2, wherein the rails (6) are mounted upon a plurality of spaced-apart vertical mullions (2) having associated anchor means (3) for supporting the mullions (2) in an upright orientation on the building structure.
4. A stone cladding system (1) as claimed in claim 3 wherein complementary interengagable formations (10) are provided upon associated mating faces of each anchor (3) and mullion (2).
5. A stone cladding system (1) as claimed in claim 4, wherein the complementary interengagable formations comprise mating serrations (10) on the mullion (2) and on the anchor (3).
6. A stone cladding system (1) as claimed in claim 5, wherein the serrations (10) have ridges arranged in a vertical orientation.
7. A stone cladding system (1) as claimed in any of claims 3 to 6, wherein each mullion (2) has two mutually perpendicular side faces (11, 12) of different depth.
8. A stone cladding system (1) as claimed in any of claims 3 to 7, wherein a reentrant slot (16) is provided along a face (11, 12) of the mullion (2) for receipt of a mounting bolt (17) having a head (18) and a shank (19), the head (18) being slidably captured within the slot (16) with the shank (19) projecting outwardly of the slot (16) for attachment to a mullion anchor means (3).
9. A stone cladding system (1) as claimed in any preceding claim, wherein the lower rail (6) has an outwardly projecting panel support arm (33) with an upturned flange (34) at an outer end of the arm (33) which is engagable within a mounting slot (35) extending along a bottom edge of the panel (8).
10. A stone cladding system (1) as claimed in any preceding claim, wherein the retaining means comprises a panel retaining clip (9), an outer end of the clip (9) having a retaining arm (42) engagable within a slot (43) extending along a top edge of the panel (8), and an inner end (39) of the dip being adapted for snap engagement with the upper rail (6).

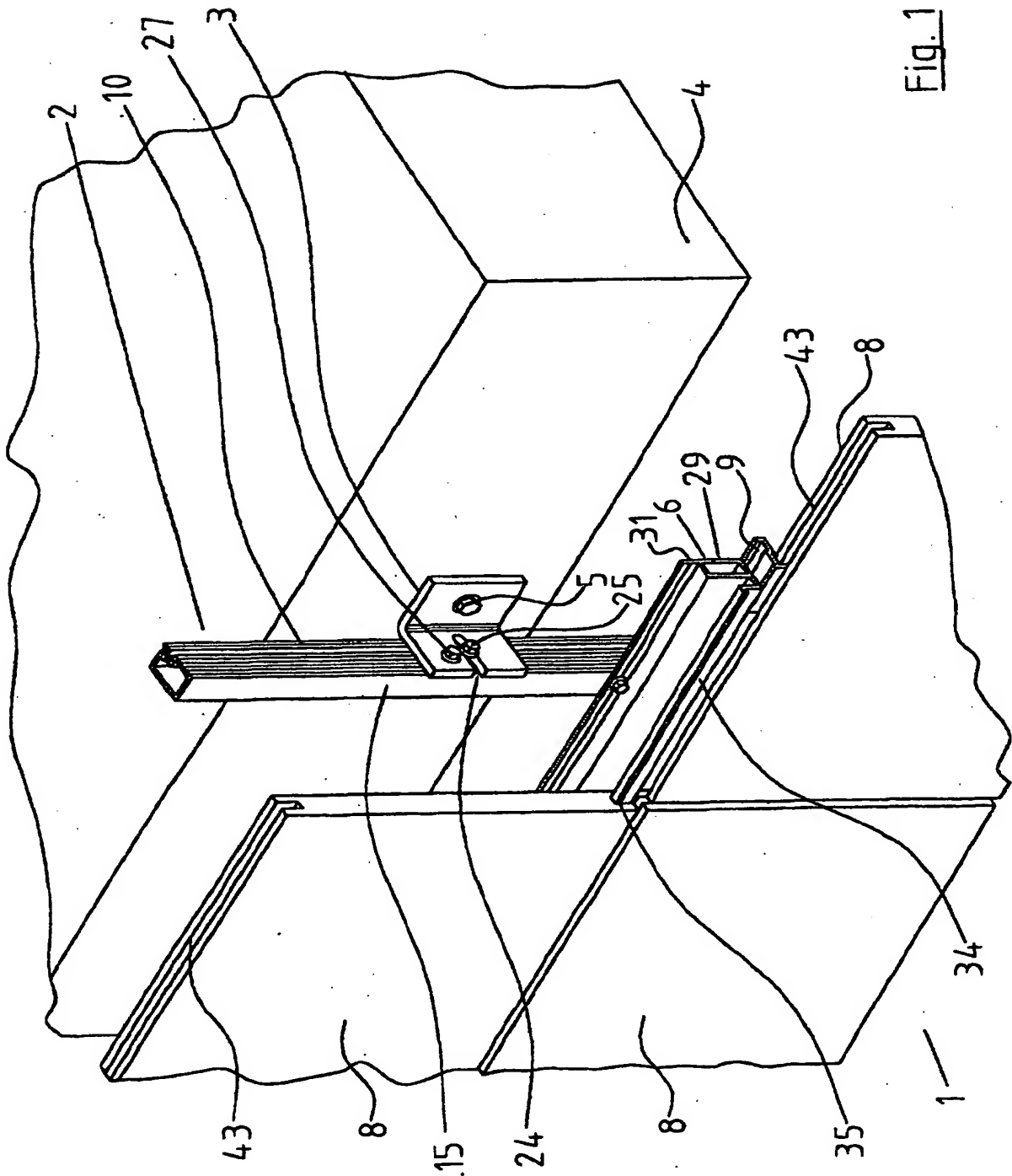


Fig. 1

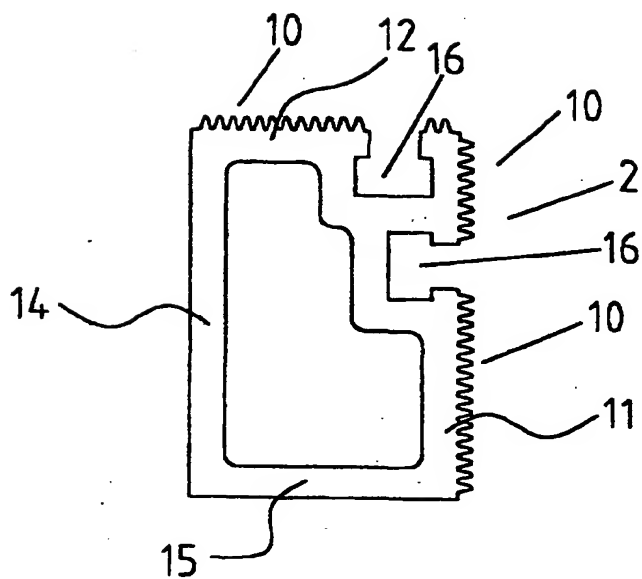


Fig. 2

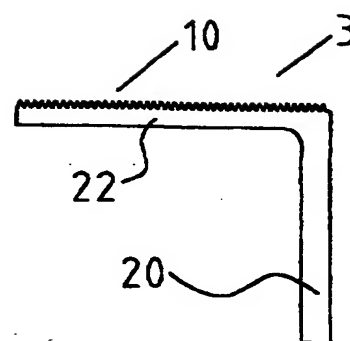


Fig. 3

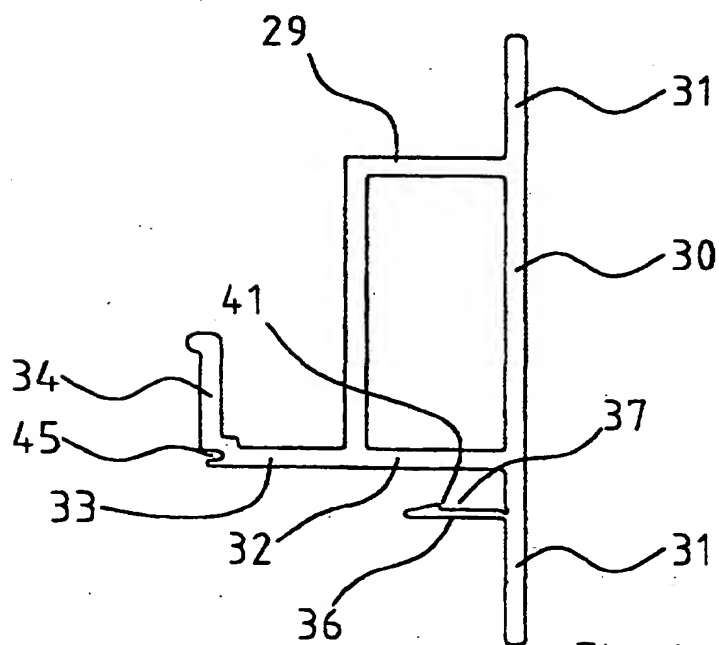


Fig. 4

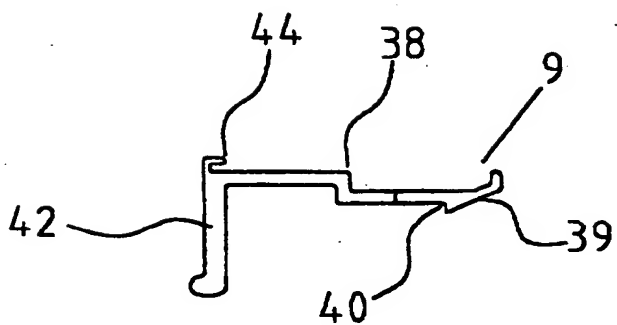


Fig. 5

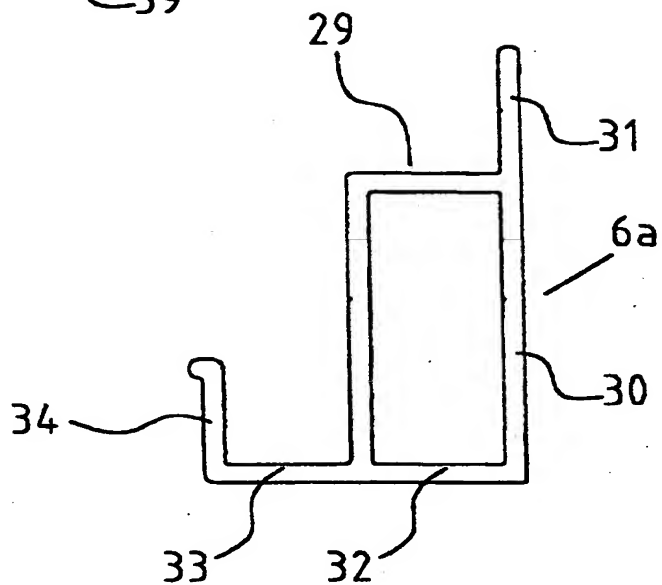


Fig. 6

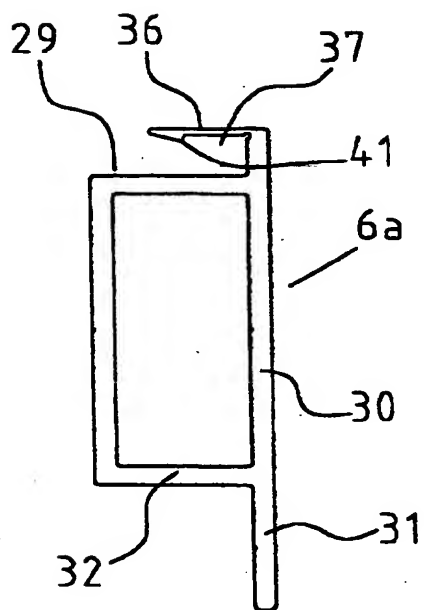


Fig. 7

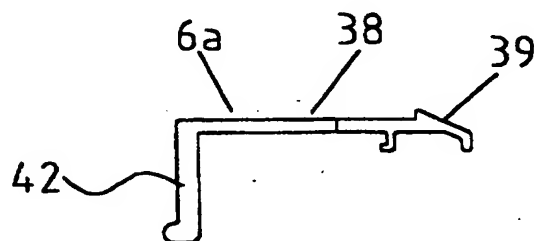


Fig. 8

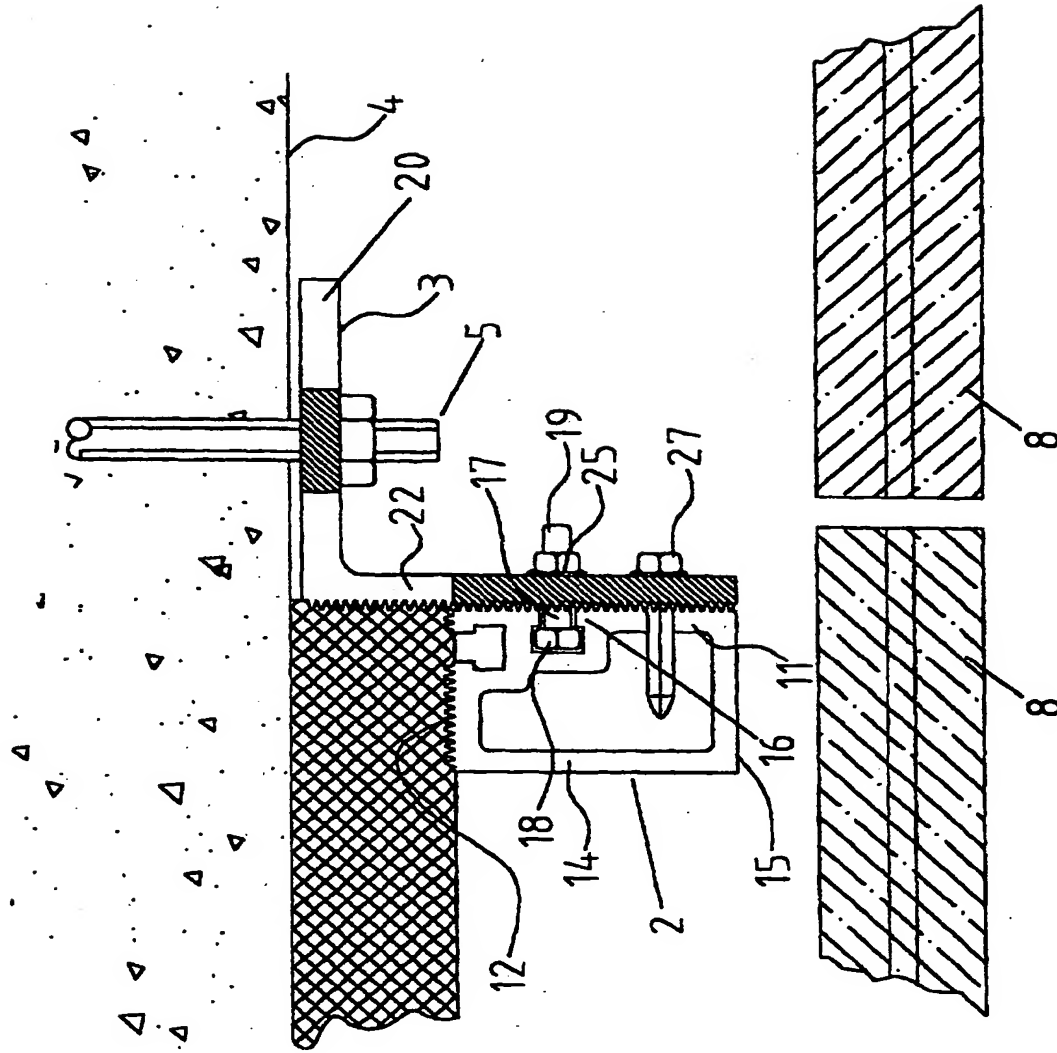


Fig. 9

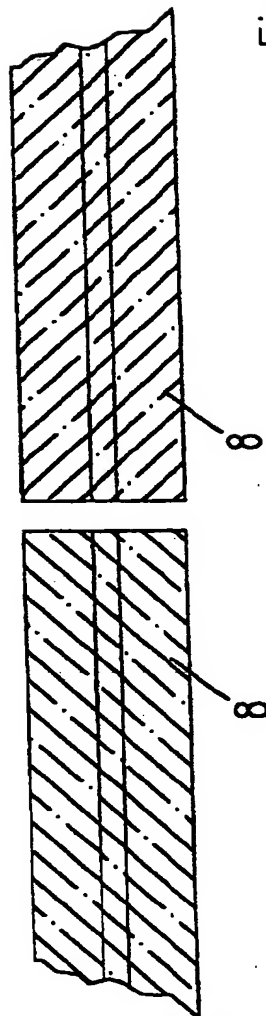
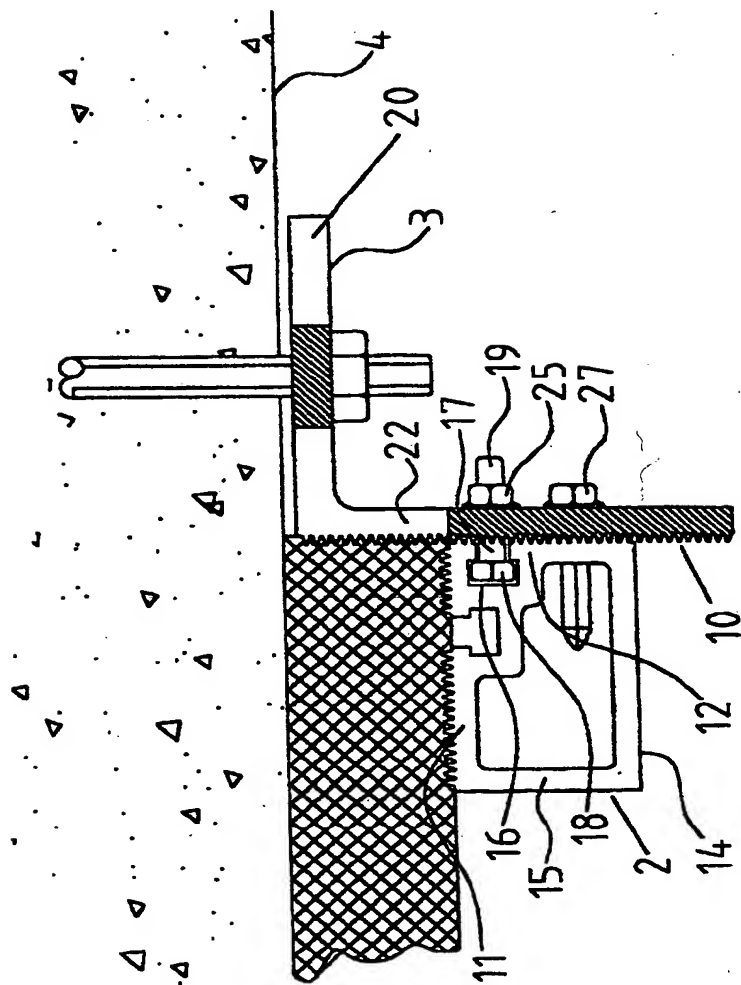


Fig. 10

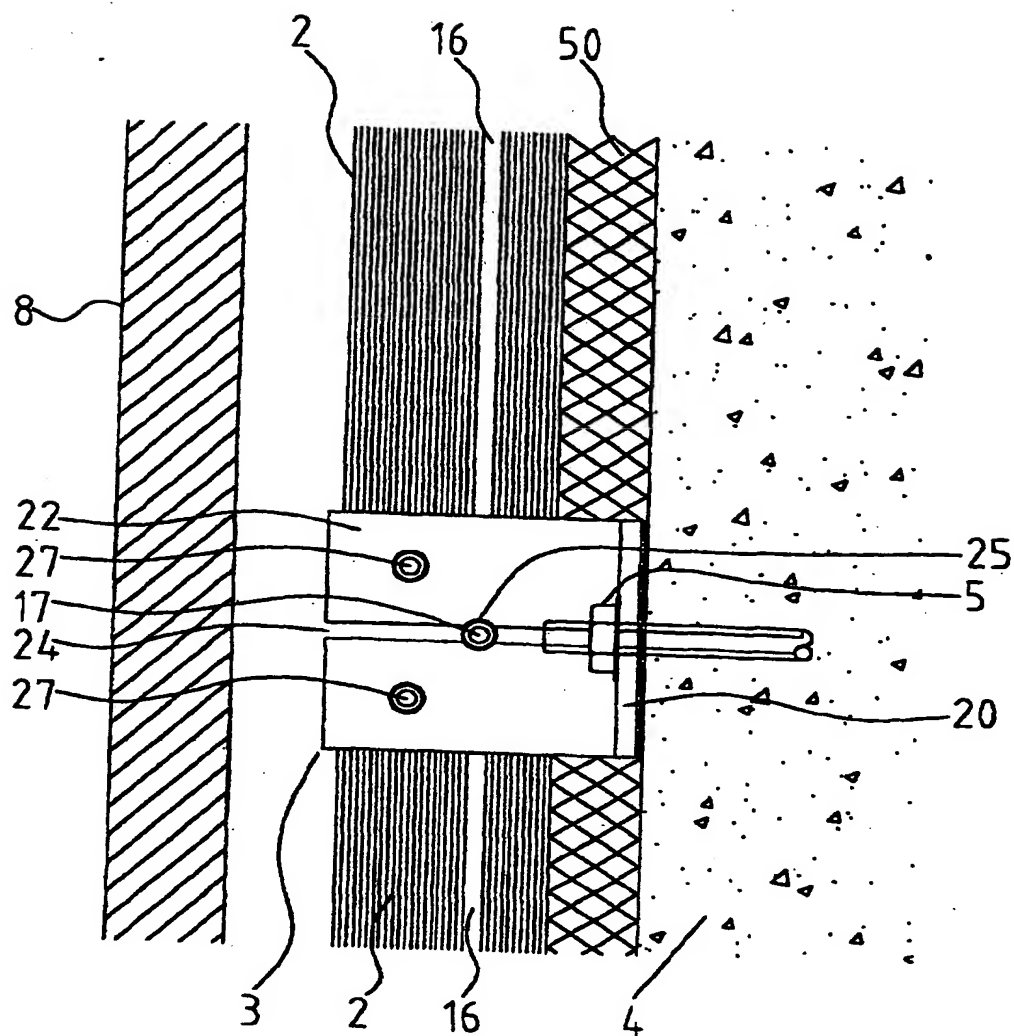


Fig. 11

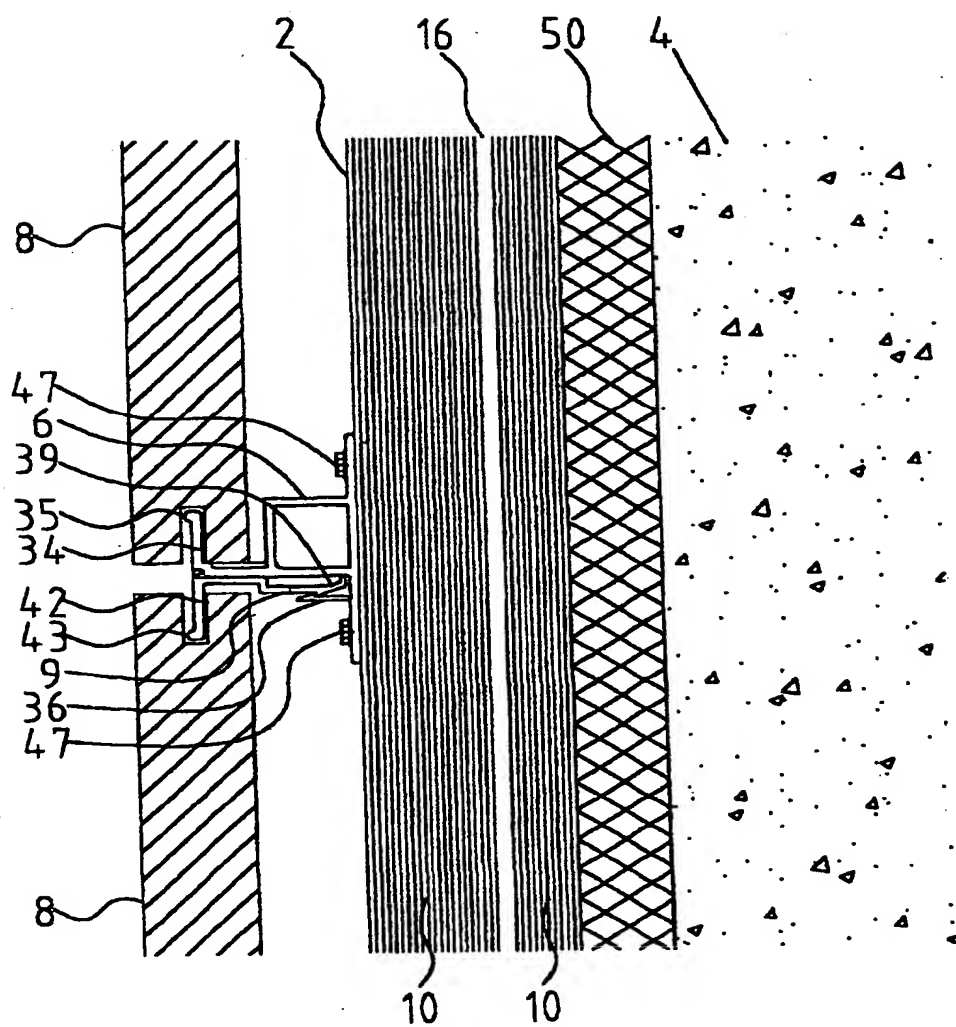


Fig. 12

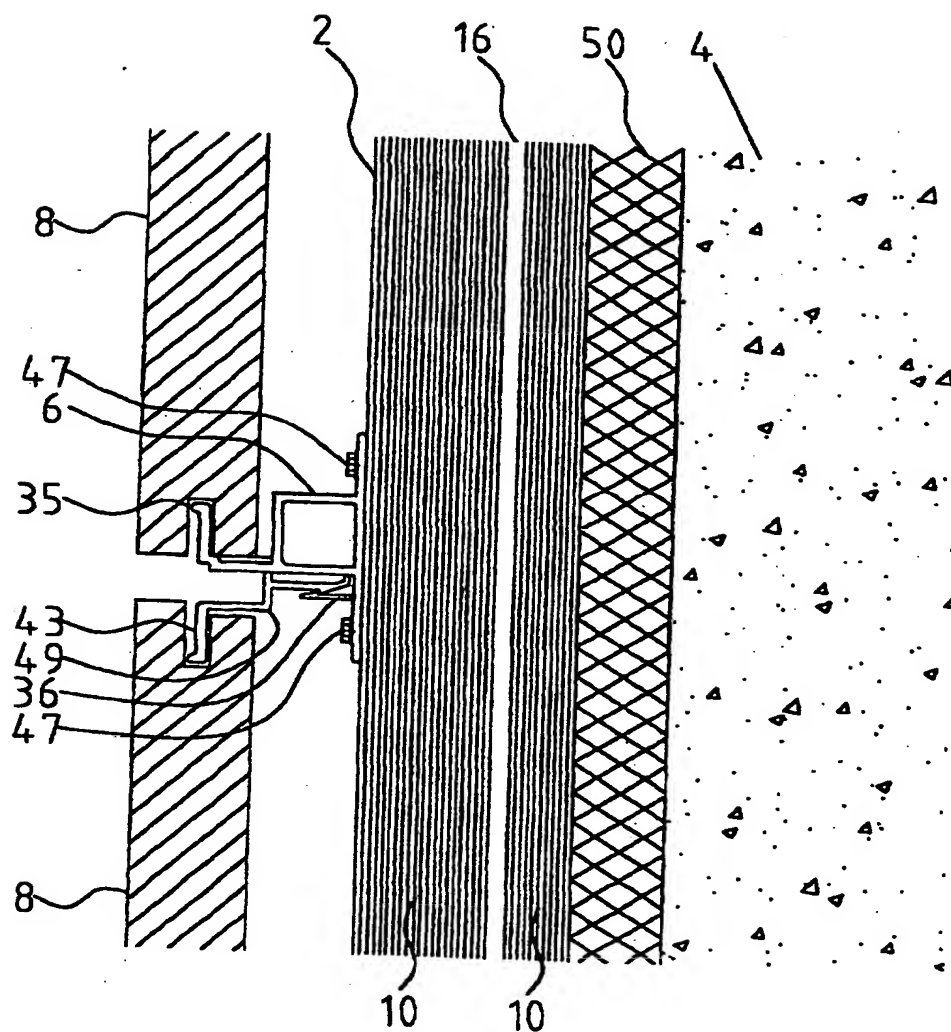


Fig. 13

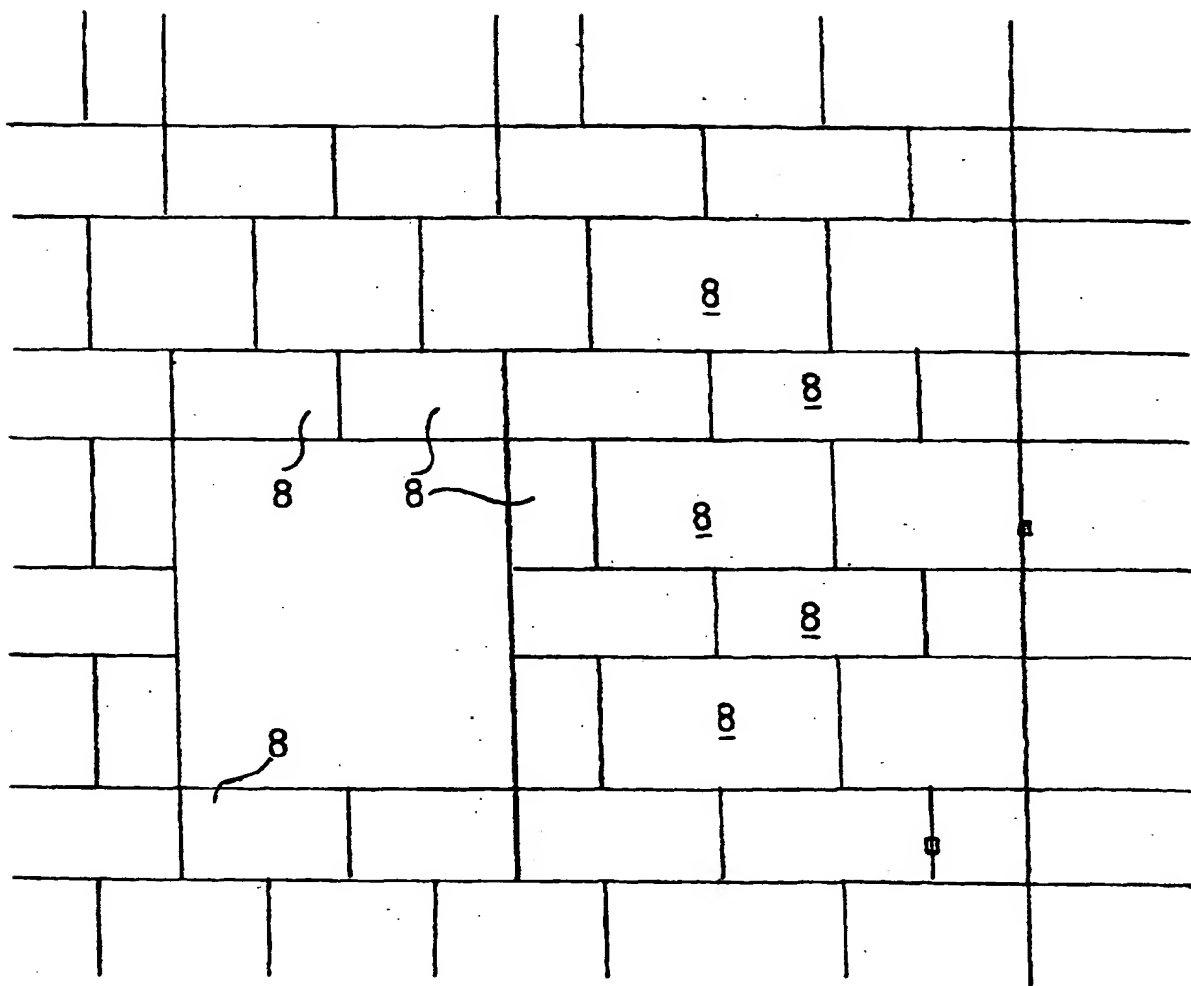


Fig. 14

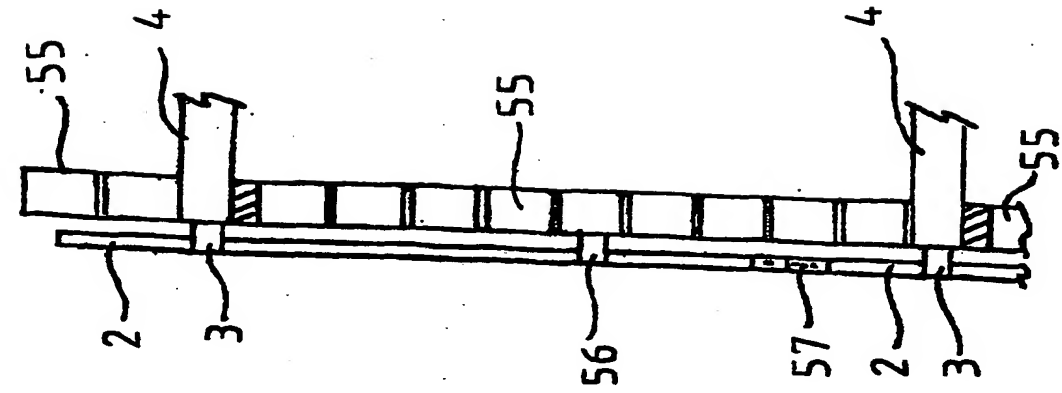


Fig. 16

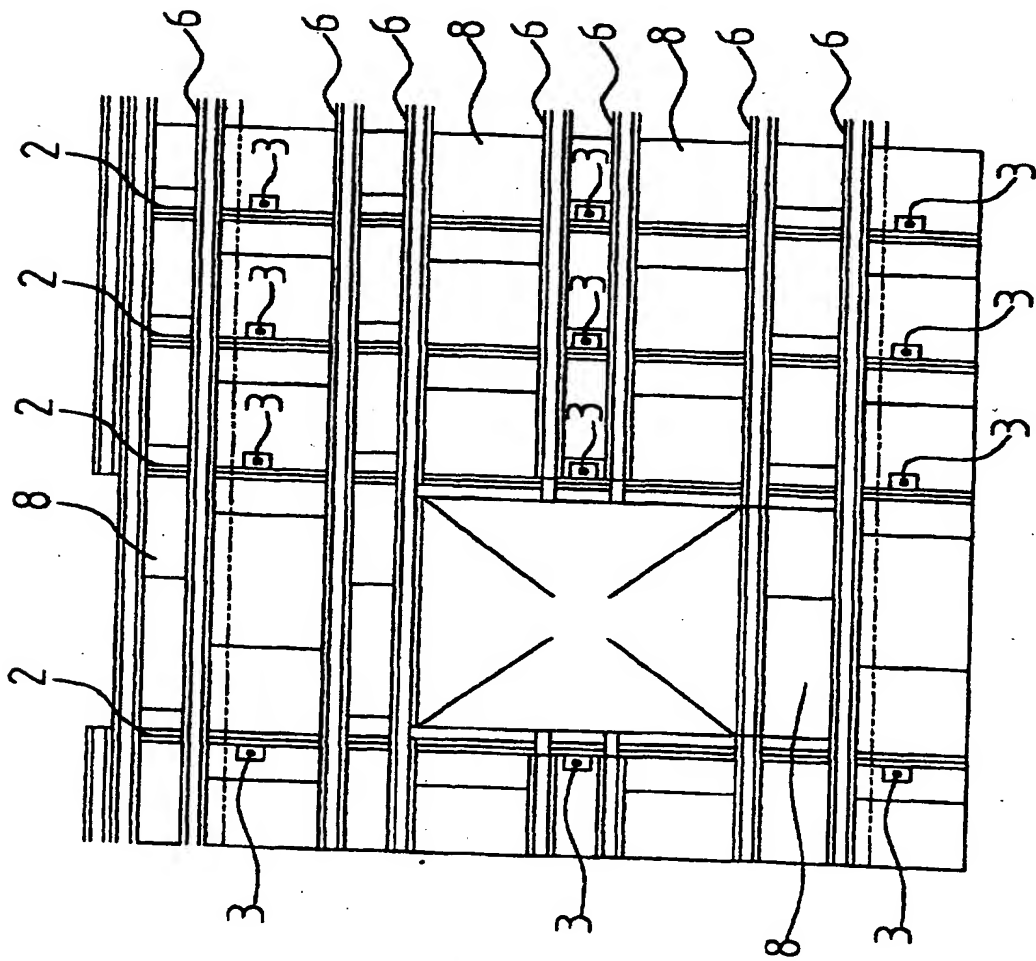


Fig. 15



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# EUROPEAN SEARCH REPORT

Application Number  
EP 00 65 0084

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			E04F
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
THE HAGUE		30 November 2000	Vijverman, W.
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EPO FORM 1503 03 82 (P40001)

**ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.**

EP 00 65 0084

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on  
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30-11-2000

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82